APPLYING CONCLUSIONS OF THE NEW ECONOMIC GEOGRAPHY FOR SUPPORTING ELABORATION OF THE SPATIAL DEVELOPMENT STRATEGIES IN THE BALTIC SEA REGION

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Applying conclusions of the new economic geography for supporting elaboration of the spatial development strategies in the Baltic Sea Region

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Abstract

Spatial development policies are frequently elaborated without sufficient economics concern. This paper aims at testing possibilities opened by concepts of the "new economic geography" to verify assumptions of decision makers from the Baltic Sea Region (BSR) countries on the negative impacts of the still existing transport barriers on regional (i.e. Baltic) integration and cohesion.

For that purpose the analysis of relative concentration of the employment in regional and sector disaggregation. has been used. The research has shown how great the difficulties, piling up before an economist willing to examine issues of spatial development in the setting of pan-European regions are. Therefore it was hardly possible to reject the hypotheses on positive influence of development of transport infrastructure on regional integration and cohesion in the BSR.

***JEL classification*:** R12, R14
***Keywords*:** absolute concentration, entropy indices of concentration, Gini coefficients of concentration, new economic geography, relative concentration

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Applying conclusions of the new economic geography for supporting elaboration of the spatial development strategies in the Baltic Sea Region

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1 Introduction. Research objective and assumptions

The aim of this study is to confirm or falsify, using new economic geography[1] concepts, somewhat intuitive assumptions of decision makers from the Baltic Sea Region (BSR) countries on the negative impacts of the still existing transport bariers on regional (i.e. Baltic) integration and cohesion. According to VASAB[2] [2005] the accessibility deficit for the eastern and southern parts of the Region[3] constitutes a considerable development barrier for the whole Region, makes it impossible to combine the existing development potentials and reduces benefits arising from economic integration (enlargement of the single market).

In the literature there is no complete concord as regards results of elimination of trade barriers[4], including reduction of transport costs, with respect to international economic integration. Lowering of trade costs seems to be the most effective tool for strengthening integration and cohesion in a situation described by the first phase of new economic geography models. This lowering causes a convergence process and a process of equalization of social well-being between countries [Fujita Krugman Venables 2000]. A critical production mass in a multipolar system, necessary for independent growth is created cumulatively, which allows to discontinue further intervention of public authorities aimed at improvement of

[1] Fujita Masahisa, Jacques-Francois Thisse, *Economics of Agglomeration*, Cambridge University Press, 2002.

[2] This stands for "Vision and Strategies Around the Baltic VASAB 2010" – the co-operation of Ministers responsible for spatial planning and development in the Baltic Sea Region countries.

[3] 'Region' beginning with a capital letter denotes great international regions (Pan-European) such as the Baltic Sea Region, whereas 'region' beginning with a small letter denotes regions within individual countries.

[4] i.e. decreasing coefficients of broadly-meant accessibility covering transport costs; asymmetry/symmetry of information; trade security; language barriers etc.

accessibility. However, the lowering of the trade costs in phase two does not have a special economic significance, at least based on new economic geography models.

Therefore public authorities should have an understanding of economic mechanisms shaping international trade.

Unfortunately there are no commonly accepted coefficients and methods allowing to answer this question explicitly. Even new economic geography does not provide clear clues as regards critical (break level) values of accessibility coefficients[5] (trade costs), after exceeding of which a convergence process is initiated.

In this situation many researchers [Brülhart and Traeger, 2003; Brülhart, 1996; Brülhart and Torstensson, 1996; Brülhart, 1998; Amiti, 1999; Walz, 1999; Krieger-Boden at all., 2002; Dohse and Soltwedel, 2002; Midelfart-Knarvik at all., 2000; Overman and Venables, 2000; Krieger-Boden, 2002] made various attempts to find out empirically if the economy of a selected international region (mainly Western Europe) has already reached a status leading to self-acting convergence. Their studies imply that in Western Europe until the 1990s a process of concentration of branches of increasing returns in central parts of the EU was taking place, whereas after this period a phenomenon of their spatial dispersion began. The results of those studies are not yet widely known and commented in spatial planners' circles. Similar studies for the Baltic Sea Region also do not exist.

2 Methods and description of data

In order to maintain comparability between results obtained for Western Europe and for the Baltic Sea Region, the intellectual achievements of predecessors, and in particular of Brülhart, and Traeger [2003] have been used, but the methods and scope of analysis have been enhanced to some extent. In order to determine the kind of mechanism of integration through trade prevailing in the Baltic Sea Region, the following issues have been examined:

[5] They depend on many hardly observable variables, such as consumers preferences for diversity i.e. elasticity of substitution between any two varieties of goods (measuring economies of scale), share of intermediate goods expenditure in the whole expenditure on factors of production, wage elasticity in agricultural sector.

a) change as regards geographic (relative) concentration of economic activity (divided into sectors) in the Baltic Sea Region in the years 1995-2002[6];

b) strength of influence of between-country and intra-country components on those concentration (deconcentration) processes;

c) change as regards absolute concentration of economic activity (divided into sectors) in the Baltic Sea Region (between regions in Baltic Europe and within countries) in the years 1995-2002.

Geographic concentration of employment may, as it is pointed out by Brülhart and Traeger, [2003, p.8], be examined in two dimensions. Firstly, as a topographic concentration, i.e. per area unit (for example one square kilometer), and secondly as a relative concentration, i.e. with regard to the number of all employed persons. In this study the relative concentration concept has been used, as the one more appropriate for analyzing relationships described by models of new economic geography.

In analyses based on models of new economic geography also absolute concentration may be useful. It shows distribution of absolute employment in the examined sector in space[7]. In the case of the Baltic Sea Region an increase in absolute concentration in some sectors (e.g.energy and manufacturing as well as in market services) may be interpreted as a faster growth of metropolitan regions (an assumption that they are characterized by high absolute employment in these sectors) at the expense of peripheral or less developed regions. This is particularly qualified with regard to changes within countries.

In the study a database on employment, managed by Cambridge Econometrics was used. This database includes data at NUTS-2 level and some NUTS-3 from 1975, divided into the following sectors: (a) agriculture, forestry and fishing, (b) energy and manufacturing, (c) market services, (d) non-market services, (e) construction. Both the market services category and the energy and manufacturing category have a number of subsets, 5[8] and 7[9] respectively. The missing regional data for some NUTS-2 countries Lithuania, and Estonia[10] were completed from national sources. Unfortunately these data have a number of weaknesses. For

[6] The author initially intended to conduct the study separately for eastern and western part of the Region. Considerable differences in economic mechanisms of integration for eastern and western parts of the Baltic Sea Region have been pointed out by Kisiel-Łowczyc (2000) and Groth (2001). However, this plan unfortunately has not been executed due to lack of appropriate statistical data.

[7] In this study the units under examinations are regions.

[8] Trade, hotels and restaurants, transport and communication, financial services, other market services

[9] power generation and mining industry, food industry and tobacco industry, textile and clothing industry, chemical industry including rubber and plastic products, electronic industry, manufacture of means of transport, other industries.

[10] This was impossible for Latvia.

Lithuania they have been collected since 1995, i.e. since creation of regional administrative level (which is NUTS-3 at the same time) in this country. In the case of Estonia these data are collected at Estonian districts level (maakonda), and their size differs considerably from size of other regions around the Baltic Sea[11]. Therefore they have been regrouped[12]

As a result, data for the years 1991-2003 for 69 regions around the Baltic Sea, covering whole territories of Denmark (3 regions), Estonia[13] (4 regions), Finland (5 regions), Lithuania[14] (10 regions), Germany (16 regions), Norway (7 regions), Poland (16 regions) and Sweden (8 regions)[15].

Table 1 Average annual employment in regions in individual countries in the years 1991-2003

Country	Denmark	Germany	Finland	Sweden	Poland	Norway	Lithu-ania	Estonia	Whole examined area
Average yearly employment in region (in thousand)	902.13	2 481.28	430.79	525.05	938.83	310.33	150.12	166.25	962.02

Source: author's own study

Existence of considerable differences as regards size of analyzed regions may lead to a so-called MAUP (modifiable areal unit problem) error.

To avoid this the basic units should be equal. In this study a single employed person is the basic unit with regard to relative concentration. But it happens to be a type of non-observable variable. The values of non-observable variables are totaled within observable regions, which results in a certain loss of information, but also allows to make use of observable regional data.

[11] The smallest maakond Hiiu has approx. 12 thousand inhabitants, and the biggest one — Harju with Tallinn as the capital has approx. 535 thousand inhabitants.

[12] using the following configuration: northern Estonia - Harju district, north-eastern Estonia - Ida-Viru, Laane Viru districts, north-eastern Estonia - Parnu, Hiiu, Viljandi, Jarva, Laane, Rapla, Saare districts and southern Estonia: Tartu, Jogeva, Polva, Valga, Voru districts.

[13] Data for the years 1991-2002

[14] Data for the years 1995-2003

[15] The necessity to include in the study all regions from countries which are only partly Baltic, such as Germany or Poland was due to the profile of the conducted study (new economic geography hypotheses concerning role of administrative boundaries of a country as regards limitation of labor force migration). Hence it was equally important to track concentration processes both in the whole Baltic Sea Region and individual countries. As a result, delimitation of the examined area departs from the one typically assumed in literature on the subject matter [Palmowski, 2000]. In the so defined area yearly annual employment in the examined period amounted to 66,379,500 persons.

Two research techniques were employed in the examination: single-parameter entropy indices GE(α) for measuring relative concentration and Gini coefficients of concentration (K) for measuring absolute concentration.

The single-parameter indices of entropy, as opposed to the traditional Gini coefficients of concentration allow for decomposition even where values taken by individual measurements (variables) are similar or identical. Thus they allow for decomposition of concentration into an internal (within-country) component and an external (between-countries) one, which fact is most important for verification of hypotheses of the new economic geography. The indices were calculated using the following formula:

$$GE(1) = \frac{1}{\alpha^2 - \alpha}\left[\frac{1}{N}\sum_{i=1}^{N}\left(\frac{y_i}{\overline{y}}\right)^{\alpha} - 1\right] \tag{1}$$

where: $\overline{y} = \frac{1}{N}\sum_{i=1}^{N} y_i$, y_i – an employed person at a specific sector "s" in „i" basic unit, N- number of basic units, α – sensitivity parameter measuring the weight given to distances among values taken by basic measurement units (it usually takes the value from 0 to 1).

In this examination the value of λ coefficient was assumed, after Brülhart and Traeger [2003, p.5], to be equal to one, since according to Bourguignon [1979] and Shorrocks [1980] „GE(0) and GE(1) are the only additively decomposable scale invariant inequality measures for which the weights of the within subgroups inequalities sum to constant and are independent from between subgroups inequalities". As a result (upon application of the L'Hopital's rule), formula no. 1 has taken the following shape:

$$GE_s(1) = \frac{1}{N}\left[\sum_{i=1}^{N}\left(\frac{y_{is}}{\hat{Y}_s}\right)\ln\left(\frac{y_{is}}{\hat{Y}_s}\right)\right] \tag{2}$$

where y_{is} – number of employed persons in sector "s" of a specific "r" basic unit, N- number of basic units (number of employed persons in the Baltic area), $\hat{Y}_s$ – share of the employed persons in sector „s" within the whole examined area.

As regards a specific research, owing to non-observable values of the variable examined with reference to the basic units, the index took on the following shape

$$GE_s(1) = \sum_{r=1}^{R}\left[\left(\frac{n_r}{N}\right)\left(\frac{\hat{y}_{rs}}{\hat{Y}_s}\right)\ln\left(\frac{\hat{y}_{rs}}{\hat{Y}_s}\right)\right] \quad (3)$$

where $\hat{y}_{rs}$ – share of employed persons in sector "s" within region "r", R- number of regions, n_r- number of basic units in region "r" (number of employed persons within region „r"), $\hat{Y}_s$ - share of the employed persons in sector „s" within the whole examined area, N- number of basic units (number of employed persons in the Baltic area).

Decomposition of the above index into a part showing only the within-country component was done using the following formula:

$$GEw_s(\lambda) = \sum_{k=1}^{K}\left[\left(\frac{n_k}{N}\right)^{1-\lambda}\left(\frac{y_{ks}}{Y_s}\right)^{\lambda} GEk_s(\lambda)\right] \quad (4)$$

where y_{ks} – employed persons in sector "s" of country "k", K- number of countries, n_k- number of basic units in country "k", Y_s – employed persons in sector "s" within the whole examined area, $GEk_s(\lambda)$ entropy indicator for sector "s" in country "k" (calculated as in formula no. 3, N being exchanged for n_k), λ =1, N- number of basic units (number of employed persons within the Baltic area).

Also the entropy coefficient between the countries, i.e. GEK, was calculated:

$$GEk_s(1) = \sum_{k=1}^{K}\left[\left(\frac{n_k}{N}\right)\left(\frac{\hat{y}_{ks}}{\hat{Y}_s}\right)\ln\left(\frac{\hat{y}_{ks}}{\hat{Y}_s}\right)\right] \quad (5)$$

where: $\hat{y}_{ks}$ – share of employed persons in sector „s" within country „k", K- number of the countries, n_k- number of basic units within country "k" (number of employed persons in country „k"), $\hat{Y}_s$ – share of employed persons in sector "s" within the whole examined area, N- number of basic units (number of employed persons within the Baltic area).

Entropy coefficients between 1995[16] and 2002 were calculated in three sections: between-regions (GE), within-country (GEw) and between-country (GEk), and then a change of the coefficients between 1995 and 2002 was calculated. Significance of the change was determined with the application of bootstrap inference. There were several factors that prompted the use of bootstrap inference. With the research being done on a Region that vast

[16] Given lack of data for Lithuania and Estonia, for the years 1991-1994 and 2003 respectively.

geographically, the results achieved had the nature of results obtained from a sample. The examined regions can be regarded as a sample from a certain global population of industrialized regions of the world. From the point of view of this research, however, it can be assumed that regions around Baltic Sea form a population of regions, and the values of concentration indicators arrived at are “sample” results because of limited accuracy of measurements of the data upon which they were determined. Thus it can be assumed that the concentration indicators are estimated at the level of their expected value and have a distribution of their own, which is, however, unknown. Unfortunately, in order to answer the question whether values of the indicators have significantly changed between the examined periods we have to know at least the asymptotic values of some parameters of the distribution, such as its variance. It is also important if there are intertemporal dependencies in the data, and in the case in question it can be supposed that such dependencies do exist (permanency of employment, living conditions etc.). It is for those reasons, and also for the inability to analytically determine accurate distributions of the examined concentration coefficients that the bootstrap analysis had to be employed. Selection of that very research method was already suggested by Mills and Zandvkili [1997], J.E.Foster and A.Shneyerov [1999], as well as Biewen [2002], as they showed that the bootstrap tests of entropy-based changes of concentration coefficients over time had very small standard errors. They are even smaller, [R.Davidson and E. Flachaire, 2004] proved, than those received thanks to the knowledge of asymptotic distributions. This is true, in particular, about small samples, as the case is here, since the number of the examined regions is only 69.

In the presented research, in order to keep maximum comparability, a procedure applied by Brullhart and Traeger [2003] was used. A null hypothesis was put forward that spatial configuration that can be a result of choices of „well-informed” firms maximizing profits is constant over time. An alternative hypothesis claims that the configuration varies in time. The results are based on 10000 replications.

The Gini coefficient (K) was calculated using the following formula:

$$K = \frac{1}{100n}\left[\sum_{i=1}^{n}(i-1)\,p_i^{cum} - \sum_{i=1}^{n} i p_{i-1}^{cum}\right] \qquad (6$$

where $p_i = \frac{x_i}{\sum_{i=1}^{n} x_i}$, „i” is the region’s number, n – number of regions, $x_{i,}$ - employed persons in region "i".

The calculations covered the years 1991-2003 and were made in two profiles: inside the countries and among all the regions within the whole examined area, as divided into sectors. Data missing for Lithuania and Latvia were supplemented with observations from the nearest year for which they were available. Next, using the bootstrap analysis, significance of changes of the concentration coefficients between 1995 and 2002 was examined.

Selection of Gini coefficients, and not coefficients of entropy for the analysis of changes in absolute concentration was stemming from the fact that in that case the requirements that the achieved results should be additive would not come into consideration.

3 Empirical results

The main results are summarized in the table presented below.

Table 2Change of Gini coefficients and coefficients of entropy from 1992 to 2003 by sectors

	Change of entropy coefficients for λ=1			**Change of Gini coefficients**	
	GE	**GEw**	**entropy coefficient among countries**	**On the population of regions**	**Intra countries**
Agriculture	positive	positive, changes statistically insignificant	positive	positive	Positive: Norway and Estonia Negative: Denmark, Germany, Finland, Sweden, Lithuania No statistically significant changes: Poland
Energy and manufacturing	positive	positive	negative, changes statistically insignificant	negative	Positive: Denmark Negative: Germany, Finland, Norway, Estonia and Lithuania No statistically significant changes: Poland, Sweden,
Market services	positive	positive	positive	positive	Positive: Norway and Estonia Negative: Denmark, Germany, Finland, Sweden, Lithuania No statistically significant changes: Poland
Non market services	negative	positive, changes statistically insignificant	negative	positive	Positive: Germany, Norway and Lithuania Negative: Sweden and

	Change of entropy coefficients for λ=1			Change of Gini coefficients	
	GE	**GEw**	**entropy coefficient among countries**	**On the population of regions**	**Intra countries**
					Estonia No statistically significant changes: Denmark, Finland and Poland
Construction	negative	negative	negative	negative	Positive: Germany and Lithuania Negative: Norway No statistically significant changes: Denmark, Finland, Sweden, Poland and Estonia

Source: author's own study

It can be easily noted that changes regarding within-country inequalities rather confirm the hypotheses of new economic geography that polarization keeps growing, whereas changes of inequalities between countries are not fully conformant with the hypotheses (negative changes in market services and in energy and manufacturing would be expected).

Table 3 GEw/GE ratio in the period put to research

SECTOR	Agriculture, Forestry and Fishing	Energy and Manufacturing	Market Services	Non-Market Services	Construction
Avg GEw(1)/GE(1)	0,1908	0,9191	0,5672	0,2011	0,8024
$\Delta_{95\text{-}02}$	-0,0416	0,0178	-0,0669	0,0551	0,1480

Source: authors own elaboration

As table 3 reveals, a greater part of inequality in relative concentration of employment, with the exclusion of the sector of agriculture forestry and fishing as well as public services can be explained by differences within countries and not those between countries. The proportions, save for construction, conform with the hypotheses of the new economic geography. Similar results for West Europe's industry and public services were achieved by Brullhart and Traeger [2003, p.32][17].

[17] The differences concern construction, in case of which sector the share of the component of within-country inequality in total inequality is more than twice higher for the Baltic Europe and agriculture where the difference is similar, albeit *in minus.* This reveals the existence of a still high, historically conditioned, importance of differences between the countries as regards agricultural employment in the examined area.

Directions of changes in 1990s are also concurrent in both researches, save for construction[18]. The directions of changes, arrived at, do not confirm the hypotheses of the new economic geography, though. In manufacturing and energy, in non-market services and in construction the share of within country concentration within total concentration of employment around the Baltic Sea rose (according to hypotheses of the new economic geography it should have, in fact, risen in industry, and got reduced in the remaining two sectors), and dropped in agriculture and market services (and according to hypotheses of the new economic geography it should have risen in market services).

Conclusions

The above analysis allows to adopt certain working hypotheses that are relevant for macroscale spatial planning. The hypotheses in question need, however, further verification. Limitations of this research, such as: a high degree of data aggregation (only 5 sectors, lack of separation of branches with economies of scale, adopting an *a priori* assumption that it was is mostly in the sector of market services and partly in the manufacturing industry sector that economies of scale would dominate), passing over the existing situation (e.g. the degree of polycentricity of the existing settlement structure), a very short time for which reliable observations could be collected and big differences in the level of employment of the analyzed regions prompt certain cautiousness in dealing with the results achieved.

It can be assumed that in the scale of the whole examined area there have appeared processes that do not conform with those expected by models of new economic geography in the situation of progressing economic integration through trading. First, inequality among the countries was rising as regards relative employment in market services and no statistically significant changes concerning industry could be observed. Second, changes of the share of the component of within-country inequalities within total inequalities did not confirm hypotheses of the new economic geography. Third, absolute inequality of employment in industry and energy sectors was dropping, which meant a rise of in the sector mostly in the regions where the employment had been small so far (in an absolute scale), i.e. where there were no big metropolises. Changes like that emerged in as many as five out of eight examined

[18] In the case of which the importance of within-country inequalities was rising in the Baltic Sea Region, whereas it was decreasing in West Europe.

countries. They can be interpreted, rather cautiously, as not very strong manifestation of economies of agglomeration in that sector.

In such a situation it is hardly possible to reject the hypotheses of VASAB that there is a positive influence of development of transport infrastructure on regional integration and cohesion. The hypothesis needs further verification. This would be possible if changes in concentration of sectors of increasing returns to scale inside the countries were examined. A barrier to it, however, is lack of suitably disaggregated data for eastern countries of the Baltic Sea Region.

Putting things generally, however, this research has shown how great the difficulties, piling up before an economist willing to examine issues of spatial development in the setting of large international regions are. Retrospective data in relevant aggregation are missing, there are no methods of attribution of data to the physical space, and models describing economic mechanisms of spatial changes are not fully verified.

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